

COE 405, Term 131

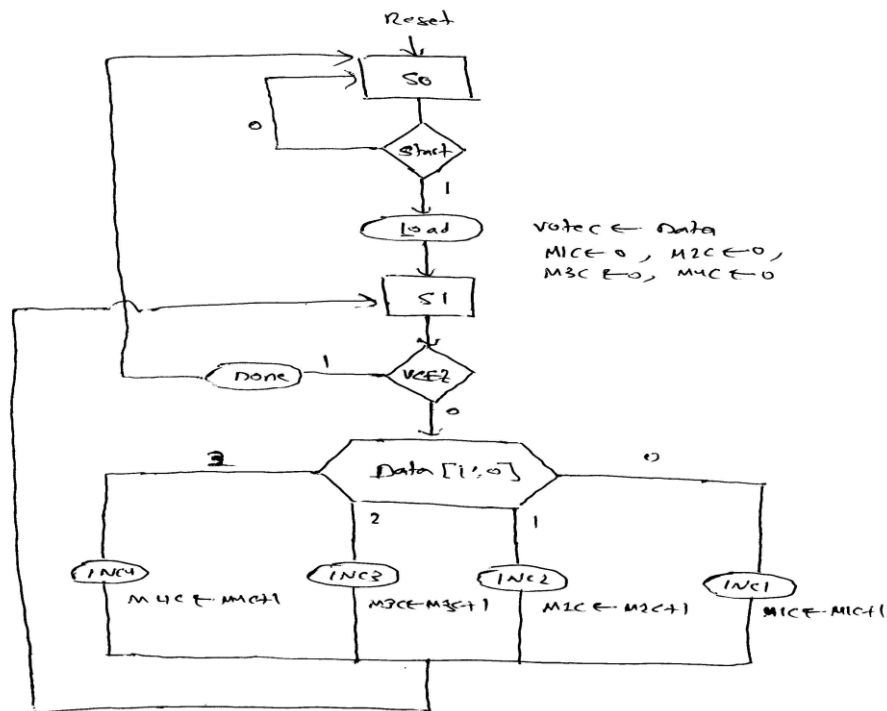
Design & Modeling of Digital Systems

HW# 3 Solution

Due date: Tuesday, Nov. 5

Q.1. It is required to design a circuit that computes the results of election and determines the winner. It is assumed that there are four members competing in the election with the following codes: Member 1: 00, Member 2: 01, Member 3: 10, and Member 4: 11. Assume that the number of votes to be counted will be given to the circuit when a *Start* input is set. Assume for simplicity that the maximum number of votes to be counted is 63. Assume that votes will be given to the circuit one vote at a time before the rising edge of each clock cycle. Once the circuit finishes computation, it will assert a *Done* signal and will generate a 2-bit output indicating the code of the winner. In case there is a tie, a Tie signal is set to 1.

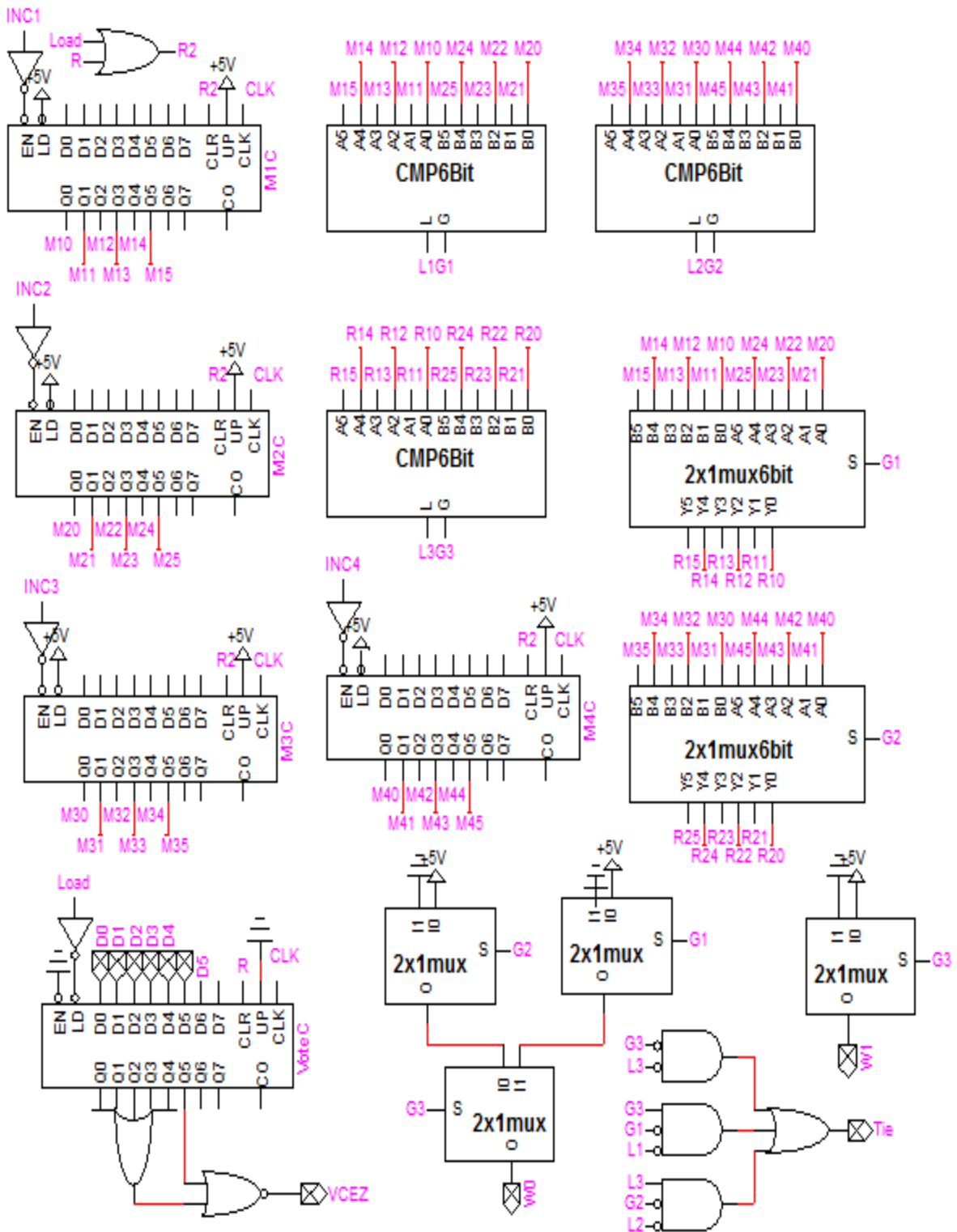
(i) Develop an ASMD chart for the circuit.



winner is computed as the largest of $M1$, $M2$, $M3$ and $M4$.

Tie is computed based on the result of comparison of $M1$, $M2$, $M3$ and $M4$.

Data Path Unit:

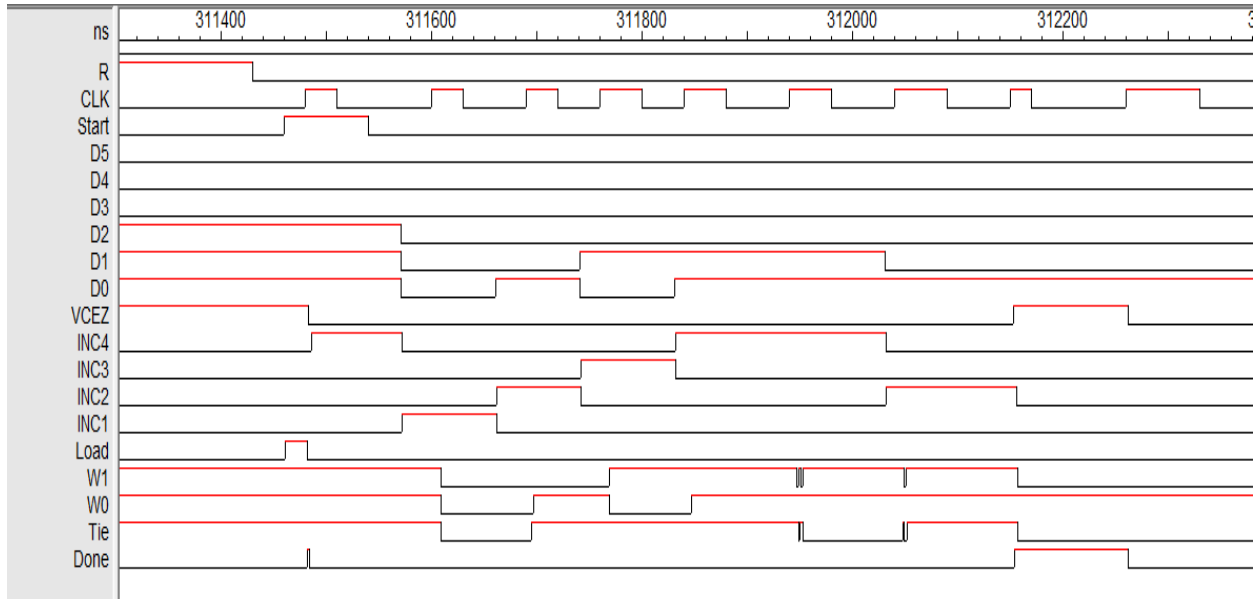


(iii) Implement the circuit and verify its correct functionality by simulation.

The simulation waveforms given below show clearly that the circuit works correctly:

In the first simulation run, the number of votes is 7 and the votes applied are: 0, 1, 2, 3, 3, 1, 1.

The winner is member 1.



In the second simulation run, the number of votes is 6 and the votes applied are: 2, 1, 2, 1, 3, 0.

There is a tie between member 1 and member 2.

